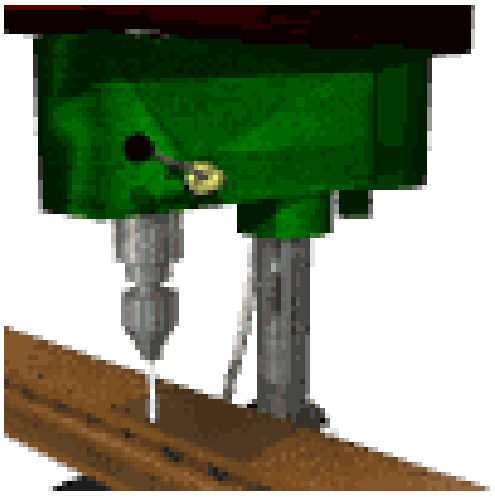
# User’s Manual

# PCB XYZ Drill Table



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# Summary Statement

The PCB XYZ drill table will drill all of the holes in a printed circuit board automatically. To use the drill table, you must have a printed circuit board (PCB), a PCB layout in Protel 99, and all of the drill bits required for the holes. There are five parts to setup before you can let the drill work.

# Guidelines for Operating the Drill Table

**Step 1: Creating a Protel Drill file.**

Note: The drill does not have any sensors to detect where the holes are. This information is taken directly from Protel. There are a few easy steps to making a drill file (See Page 2).

1.1) Open the Protel Printed Circuit Board file. This is the same file that you used to create the PCB.

1.2) Pull down “File”, then click on CAM Manager. Protel should now open a CAM output file.

1.3) Pull down “Edit”, then click on “Insert NC Drill”. Protel will pop up a window labeled NC Drill Setup.

1.4) Make sure that the “Units” selection is “Millimeters”, then click ok.

1.5) Pull down “Tools”, then click on “Generate CAM files”.

For more information on how to create PCB’s, schematics or drill files, refer to the users manual for Protel 99.

**Step 2: Mount Printed Circuit board.**

Note: The drill can create some large forces on the printed circuit board. It is important to secure the printed circuit board in place.

2.1) Inside the drill cage, remove all four wing nuts.

2.2) Place the PCB towards the middle of the drill cage. Be sure that the PCB is not overhanging the wood on any side. Also make sure that the front of the PCB is facing up.

2.3) Place the two pieces of angle aluminum underneath the two pieces of square aluminum. Do not take the square aluminum off its guides.

2.4) Position the angled aluminum on either side of the PCB. Over lap the edges of the board, but be sure that the positions for the holes are not covered.

2.5) Replace the wing nuts and tighten until they are snug.

**Step 3: Load software and power drill.**

Note: At this step, you can see the drill calibrate itself to the front left corner.

3.1) On a PC, load the software. Connect a serial cable from the COM 1 port on the PC to the serial port on the left side of the drill table.

3.2) Ensure that the power cable is plugged in, and turn on master power.

**Step 4: Calibrate the drill to the position of the PCB.**

Note: Give the drill table the precise location of two points, and it will be able to calculate
the position of the rest.

4.1) Choose a hole on the PCB. Use the manual controls either on the software or on the case to move the drill directly above the hole. You should fine tune to this hole as much as possible.

4.2) Lock in this hole by checking the Zero reference box, and entering the reference number. You can find the reference number of the hole by holding the mouse of the same point on the grid shown.

4.3) Choose a second hole as far away from this hole as possible. Once again, use the manual controls to maneuver the drill directly above the new hole.

4.4) Check the box labeled "sample reference" and enter the reference number in the box above.

4.5) To set the depth, move the drill tip close to the board. Then move it away while counting the steps. Check the box indicating zero reference and enter the number of steps in the box below. Add 200 to the number to drill through most PCB's,

**Step 5: Run the drill.**

Note: Let the drill do its work. You can pause the drill at any time using the pause buttons on the manual control.

5.1) Click run, then click start.

# Replacing the Driver Board

**List of Tools necessary:**

Multi-Driver screwdriver (only tool necessary).

Note: If the driver board fails to operate, it can be replaced with a compatible back-up driver board. There are a few differences between the two boards therefore the steps must be followed exactly to ensure correct operation.

**Caution**: Proper handling precautions must be taken to prevent damage through ESD (electrostatic discharge).

- **Powering down the system.**

Step 1. Turn main power switch and drill power switch off (if it is on).

Step 2. Unplug the main power cable from the housing and wall socket. Unplug the drill power cable from the housing. Unplug the DB9 cable from the housing.

- **Removal of the housing.**

Note: When removing the housing, proper care must be taken to ensure that none of the wires and cables hang up or catch on any of the power supply components or micro-controller and driver board components.

Step 1. Remove the eight screws from the bottom of the housing (Refer to appendix 1, page 1).

Step 2. Remove the end panels by removing the two screws on the top of the housing at each end (Refer to appendix 1, page 1).

Step 3. Gently lift housing up while slightly spreading bottom enough. Lift the housing up high enough to be able to access the boards inside as well as the connectors (Refer to appendix 1, page 2).

Step 4. Unscrew the earth ground cable (green) from the chassis.

Step 5. Tilt housing up on end (onto power socket end). Refer to appendix 1, page 2.

- **Removal of the bipolar driver board.**

Step 1. Disconnect both ends of the interface cable that connects the micro-controller board to the motor driver board.

Step 2. Disconnect the 24V, 5V, and GND cables.

Step 3. Unscrew the X, Y, and Z motor leads from the screw gate terminals on the driver board.

Step 4. Remove the board.

- **Connecting the replacement board.**

Note: Since the replacement board uses the center taps of the motors, the leads must be connected properly in order for the new board to work.

Step 1. Put the replacement board in the same location as the old board.

Step 2. Connect the interface cable (supplied with driver board) to the driver board and the micro-controller board. Ensure that the pin numbers match up.

Step 3. Connect up the X, Y, and Z motor leads. Ensure that the lead colors match the labels on the screw gate terminals.

Step 4. Connect the 24V, 5V, and GND cables to the board.

- **Replace the housing.**

Step 1. Fasten the earth ground back onto the chassis.

Step 2. Put the main housing back on. Replace the screws.

Step 3. Replace both the end panels.

Step 4. Re-connect the power cables and serial cable to the unit.

Note: If you followed these steps, the drill table should now be fully operational.

# Rules to follow to ensure safe drilling operation

- **DO NOT OPEN CASE WHILE THE POWER IS ON.**

  There is a high voltage line entering the case, which can cause bodily harm or loss of life.

- **DO NOT PLACE BODILY PARTS NEAR THE CAGE WHILE THE DRILL IS IN MOTION.**

  The drill has a very sharp bit that is moving at high speed. It will not slow or stop automatically if it starts to drill into your hand.

- **USE PROTECTIVE EYE AND EAR PROTECTION.**

  The drill can be very loud which can be damaging to your hearing. There may also be flying particles from the drill as the drill spins at very high speeds. A broken drill tip at high velocities could do serious damage to sensitive optic nerves.

- **DO NOT LIFT THE DRILL TABLE ALONE.**

  The drill table is quite heavy and awkward. At least two people should lift the table. Remember to bend with your knees while lifting.

- **DO NOT MOVE THE DRILL HORIZONTALLY WHILE DRILLING A HOLE .**

  Drill bits are very fragile, and a sideways movement could easily shear off a bit. Turn on drill before mounting project. The initial calibration sequence will drive the drill bit to the front left corner. The drill will not stop if a mounting bracket is in the way. It is also a good idea to mount the drill bit after mounting your project.

# 4.0 Mechanical Structure

## 4.1 Drill Cage

The drill cage is approximately a 60x60cm cube containing the drill assembly.

## 4.1 Power Supply - Micro Controller and Driver Housing


This housing houses the Micro-Controller, Power Supply and Motor Driver circuitry.

### 4.1.1 Drill Power Switch

The switch turns on and off the drill power. Setting the switch Up will turn on the drill and light the red light to the right of the switch.

### 4.1.2 20x2 Line LCD

The 20x2 Line LCD is for user feed. It provides the location of the drill position X coordinate, Y coordinate and Z coordinate.

### 4.1.3 4x4 Keypad

The 4x4 Keypad is for user input. Using this keypad the user can position the drill anywhere in its range.

- - Moves the drill shaft to the left.
- - Moves the drill shaft to the right.
- - Moves the drill shaft away from you.
- - Move the drill shaft toward you.

P – Pauses the drill movement.
S+ - Decreases the step speed by increasing the delay.
S- - Increases the step speed by decreasing the delay.

UP – Moves the Shaft up.
DN – Moves the Shaft down.

5 – make the step size 5.
25 – make the step size 25
100 – make the step size 100.
1000 – make the step size 1000.

### 4.1.4 Main Power Switch

The switch turns on and off the power supply. Setting the switch up will turn on the main power and light the red light to the right of the switch.

### 4.1.5 Intake Fan

Blows cool air into the housing.

### 4.1.6 DB9 Serial Communication

Serial communications plug for external control.


### 4.1.7 Power Plug

Plug for powering the entire system.

### 4.1.8 Drill Plug

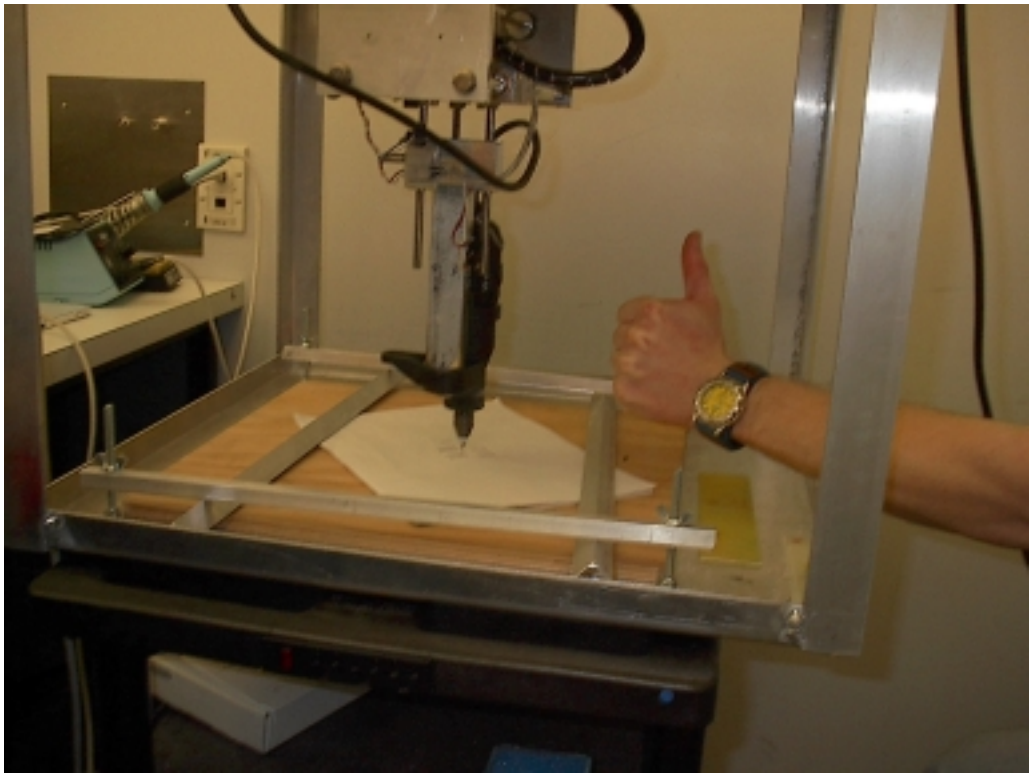
Plug for power the drill.

### 4.1.9 5A Fuse

Fuse for protection.

### 4.1.10 Outtake Fan

Blows hot air out of the housing.



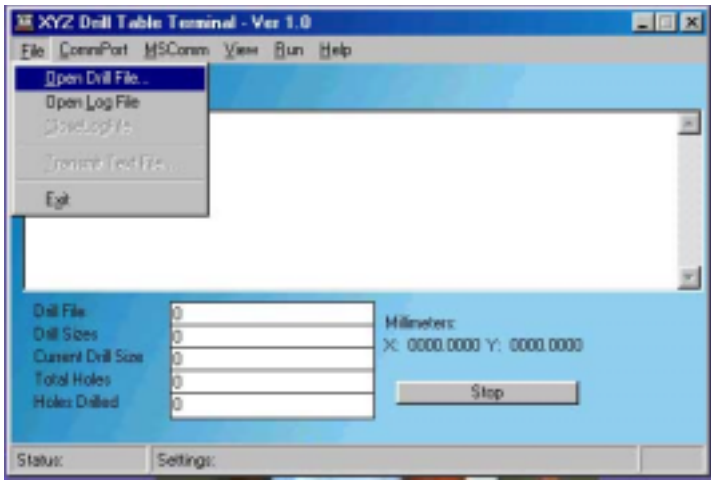
#### 4.1.10 PCB Mounting Platform

Allows the user to securely mount their PCB prior to drilling.

# 5.0 User Software

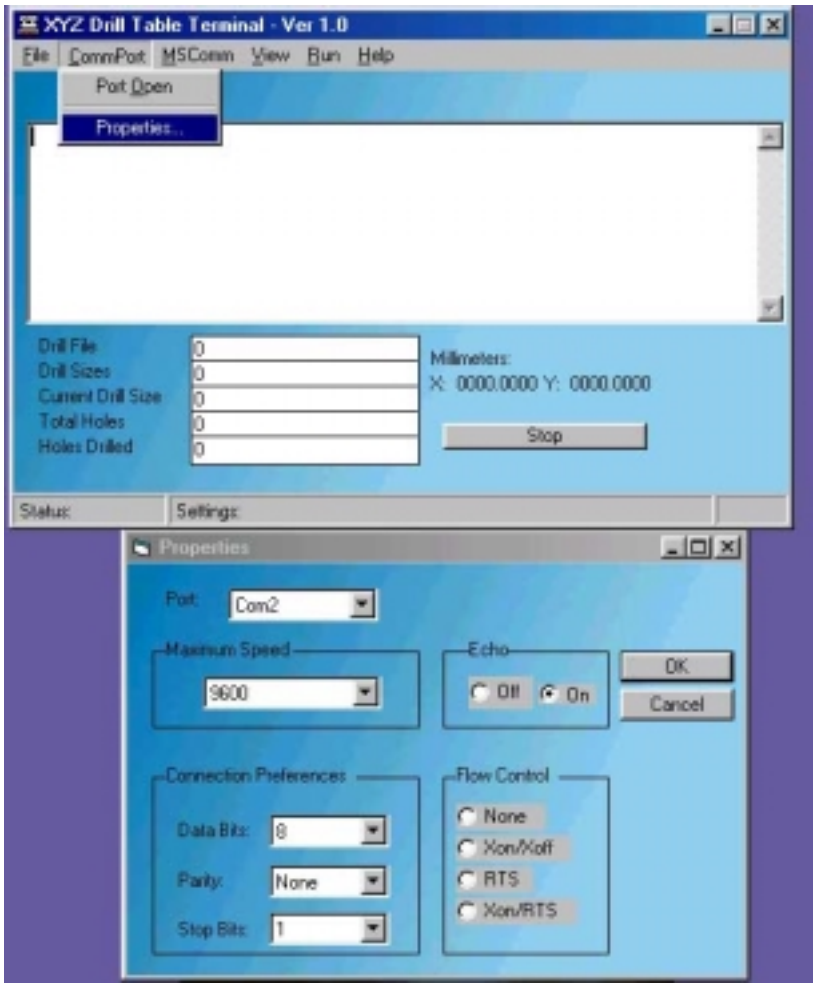
### 5.1 File

Open a drill file for drilling. Open a log file for logging all communications.



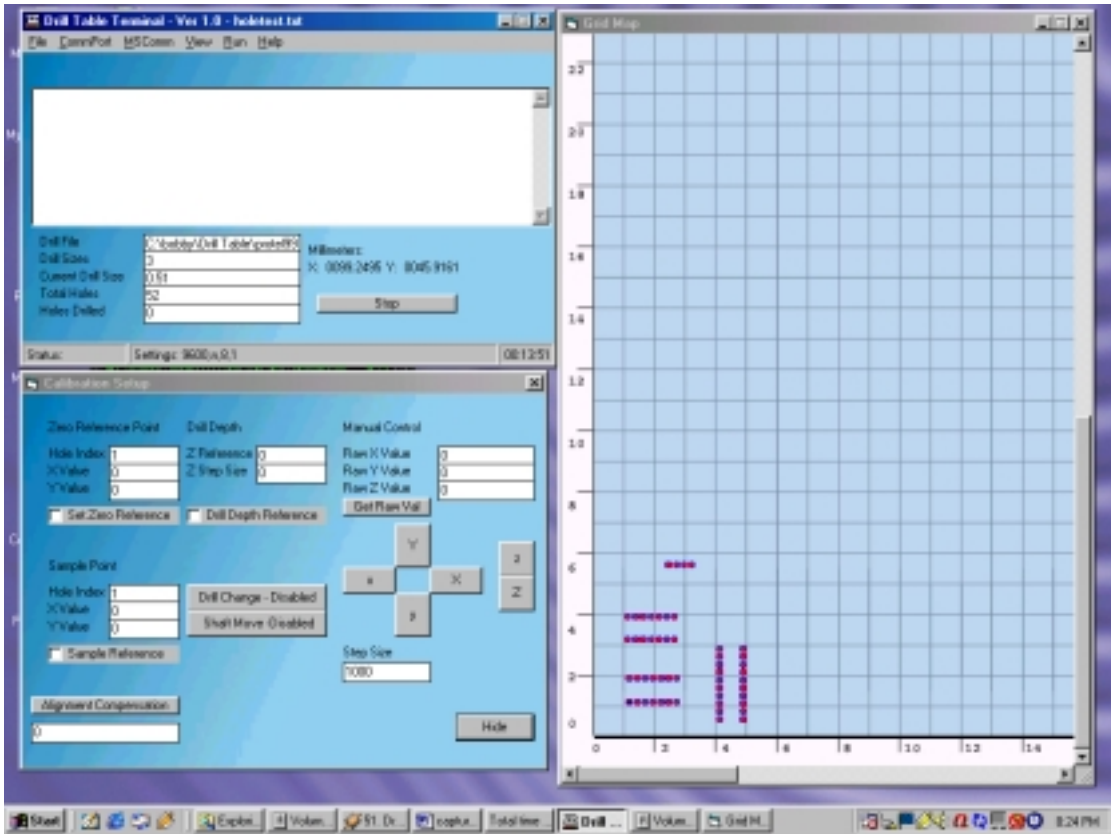

## 5.2 CommPort

Adjust the settings 9600 baud, 8 bit, 1 parity. No flow control echo on and whatever comm. Port you have selected. The mico-controller module is hardwired for 9600 so this comm. Port has to be set to 9600. To open the comm. Port you click on Port Open, this will put a check beside the menu icon indicating the port is open.



## 5.3 Generate and Plot

Extract the data points from the Protel file by selecting the MENU - RUN – Generate command. Open the Grid Map by selecting MENU – VIEW – GridMap command. Plot the data points by selecting MENU – VIEW – Plot.



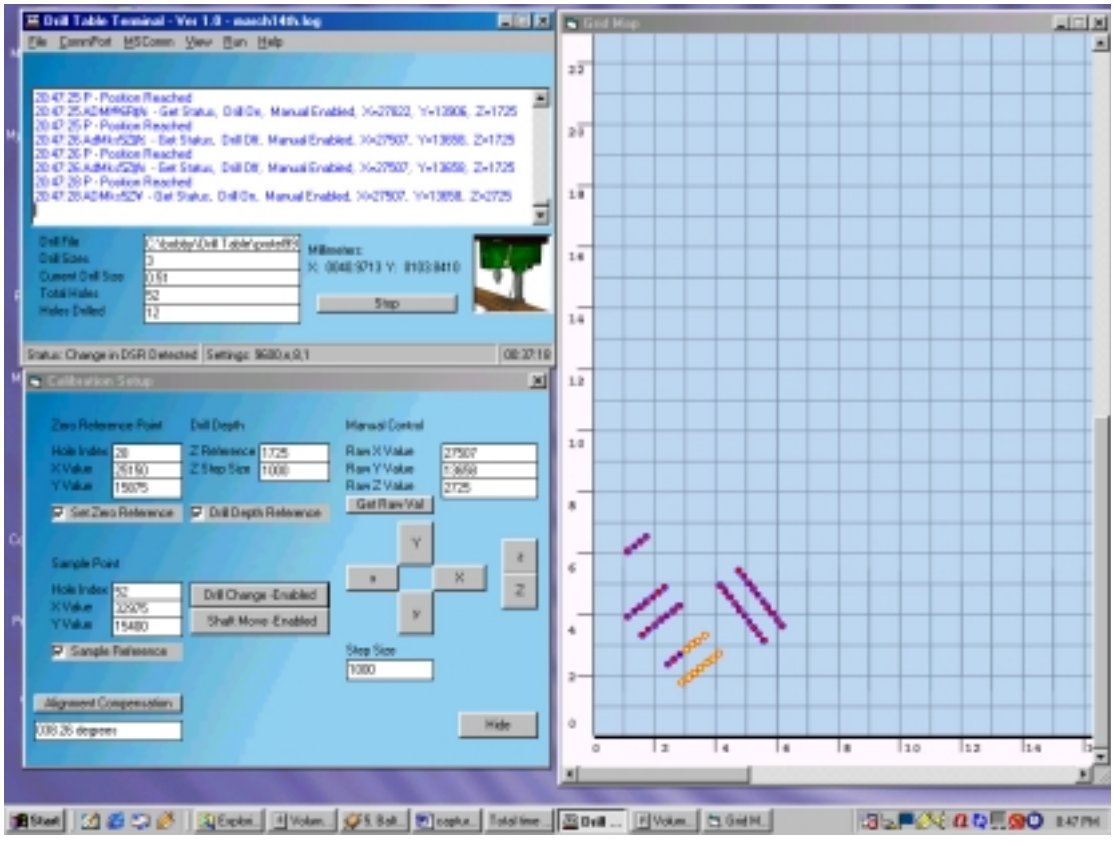
## 5.4 Compensation Alignment

Open the Calibration form by selecting MENU – RUN – Calibrate.

The compensation alignment requires one reference point and one sample point.

- Choose a reference point near the outside of the layout of holes.
- Manually move the drill bit as close to the reference hole as you can.
- Check the Zero Reference Box to lock this value.
- Choose a sample point. This point should be approximately across to the other side opposite of the reference point for best results.
- Manually move the drill bit as close to the sample point hole as you can.
- Check the Sample Reference Box to lock this value.
- Click on the Alignment Compensation. This will run the calculations necessary for alignment.

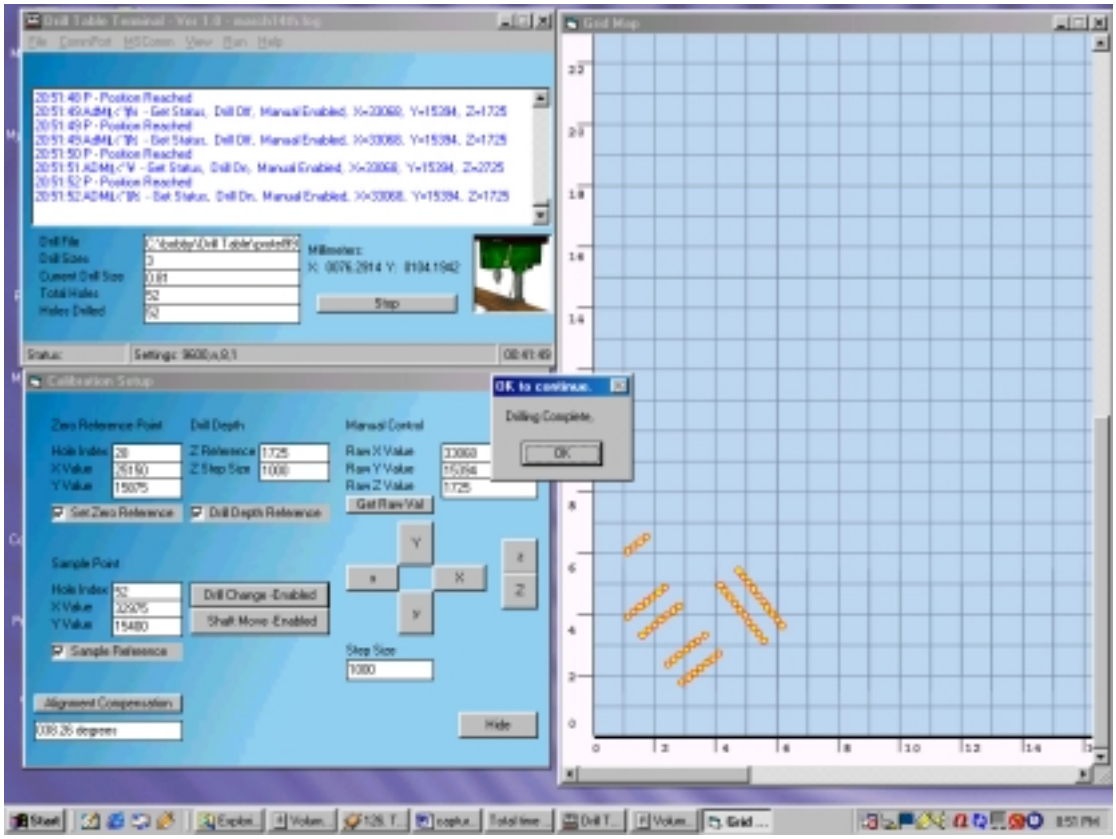
You can set the Drill depth by choosing a Z Reference point. This point is the home position for up and down movement of the shaft. The Step Size is the amount of offset (movement added)




Drill Change Enable/Disable is a toggle button. This will enable or disable the prompting of the user to change drill bits when the different sizes of holes are detected.

Shaft Move Enable/Disable is toggle button. This will enable or disable the up and down movement of the shaft. This helps in doing a test run prior to an actual drilling.

Get Raw Val is a toggle button. This button allows the user to update the current position into the text fields.




After a drilling process is done the software will stop the drill and prompt the user.

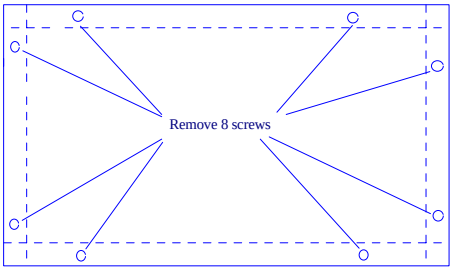
# Appendix I

# REPLACEMENT OF DRIVER BOARD

# VISUAL AIDS

Removal of the housing

Step 1

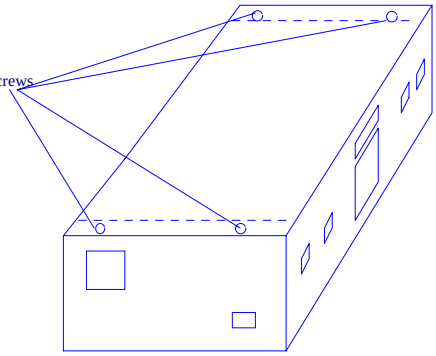



Bottom view of housing

Removal of the housing

Step 2

Remove 4 screws



PCB DRILL TABLE



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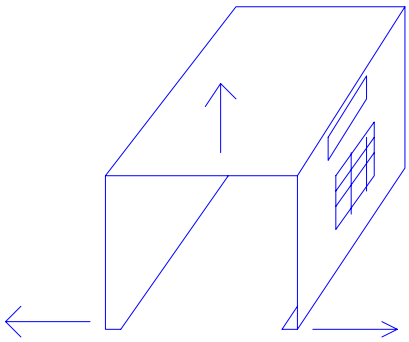
Removing the housing

Step 3

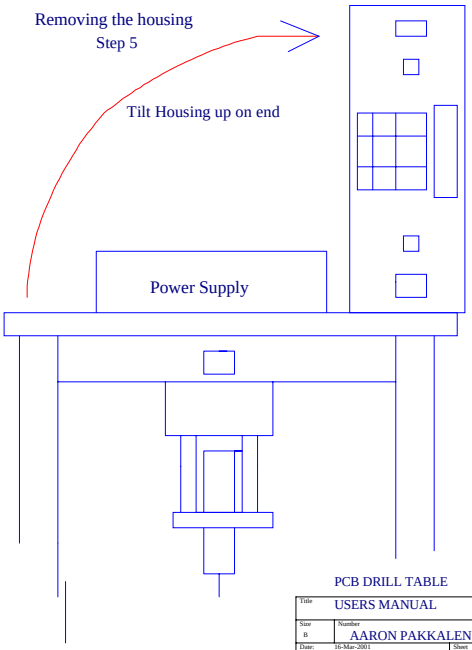


Spread bottom slightly then tilt up

Removing the housing

Step 5

Tilt Housing up on end

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